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Research on Evaluation Method for Public Participation in Operation Management of Rural Drinking Water Safety Project

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Abstract: The concept of public participation in operation management of rural drinking water safety project is proposed in this study. Evaluation indicator system for public participation in operation management of rural drinking water safety project is constructed based on 14 aspects including participation degree of fund raising, participation degree of labor investment and participation degree of manager recruitment. Meanwhile, by means of matter-element analysis method and group decision analytic hierarchy process, the evaluation model for public participation in operation management of rural drinking water safety project is established.

Key words: Public participation, rural drinking water safety project, operation management, participation evaluation

INTRODUCTION

For a long term, especially under the planned economy condition, the construction and management of public projects is undertaken by the governmental departments in China all the time. Under such a background, the management mode with the only management subject of the governmental departments comes out. Thus, the governmental departments have low management efficiency and poor resource allocation effect. After the reforming and opening up, along with constantly increasing democratic administration and consciousness of civil right, the degree and scope of public participation in public projects are increasing. The government also knows the important meaning of public participation to the increase of governmental investment benefit and thus regards the scientific and democratic governmental investment project decision as the important direction for the reform of Chinese investment system (Wang *et al.*, 2010).

Being the most important measure of solving livelihood issues, rural drinking water safety project plays an important role in solving problem of rural drinking water safety project. Rural drinking water project involves with a vast scope, resulting in influence on society, economy, culture and ecological environment. It is difficult to realize objectives of multiple aspects only by governmental power during the construction of rural drinking water safety project. The scope and degree of public participation should be enhanced while the scope, process and mode of public participation should be improved. Degree of public participation and its role in social and economic development is the important

standard for the evaluation on political democracy and open degree of a country.

In order to effectively know the degree of public participation in the operation management of rural drinking water safety project, the basic situation of public participation should be made clear through investigation analysis. In addition, quantification method should be used to directly reflect the public participation in the operation management of rural drinking water safety project.

ANALYSIS ON ROLE AND CONTENT OF PUBLIC PARTICIPATION IN RURAL DRINKING WATER SAFETY PROJECT

Analysis on role of public participation in rural drinking water safety project: Rural drinking water safety project involves with a great scope and quantity scattered in the country. At present, rural drinking water safety supply in China includes 2 modes: Centralized water supply and distributed water supply. Under different water supply modes, content and type of user participation has certain difference: Scope of power supply under the centralized water supply mode is great and the project construction and operation management has strong complexity and profession. The design, construction and operation management of water supply facility and main pipeline are usually undertaken by relevant business departments. However, village pipeline of centralized water supply and construction and operation management of single village water supply facility with small size should be attended by farmer users (Hui and Liu, 2011).

Participation of users in the operation management of rural drinking water safety project has following functions.

Benefit to solve many problems in the rural drinking water safety project management. In actual operation process of rural drinking water safety project, there are following problems:

- Lack of village-level manager
- Water price cannot support the operation and maintenance cost, difficult water fee gathering
- Potential conflict generated from improper village-level pipeline design during the design and construction process
- Difficulty in organizing the labor investment among farmers
- Insufficient water source protection and water quality inspection
- Apart of farmers have insufficient understanding of safety drinking and water conservation. When users participate in the operation management of rural drinking water safety project, the above problems can be solved effectively to guarantee the operation efficiency of rural drinking water safety project

Beneficial to increase the reasonability of the decision. When users participate in the operation management of rural drinking water safety project, regulations and rules, water price standard and resource right distribution can be implemented better in line with local situation and actual situation which guarantees that the management work have better population base and is understood and implemented by population. In addition, with guarantee of users' benefit, relevant decision-making work can be more scientific.

Beneficial to long-term effective operation of rural drinking water safety project. When users participate in the operation management of rural drinking water safety project it is better to maintain sustainable application of rural drinking water safety project and guarantee the effective implementation of rural drinking water safety work.

ANALYSIS ON CONTENT OF PUBLIC PARTICIPATION IN RURAL DRINKING WATER SAFETY PROJECT

During the operation management of rural drinking water safety project, the user participation management system is included. Users should participate in the whole process, with the specific performances: Knowing the situation, participating in the decision-making process,

participating in the formulation and implementation of relevant system, sharing the benefit, participating in the monitoring, undertaking certain responsibility and liability and making corresponding contribution. During the operation management of rural drinking water safety project, the contents of participation management are mainly reflected in system construction, implementation and supervision. Specifically, content of public participation in rural drinking water safety project includes: fund raising; labor investment; manager recruitment; decision-making system; information disclosure system; water usage and irrigation system; project maintenance system; dispute coordination system; financial management; determination of water pricing and water fee collection; formulation of award and punishment measure; protecting rural water environment and participating in the water quality inspection.

CONSTRUCTION OF EVALUATION SYSTEM FOR PUBLIC PARTICIPATION IN RURAL DRINKING WATER SAFETY PROJECT

Concept definition of public participation in rural drinking water safety project: Public participation in rural drinking water safety project refers to the participation degree of public people in aspects of operation management of rural drinking water safety project such as decision-making, system formulation and implementation, benefit sharing and supervision.

CONSTRUCTION OF EVALUATION INDICATOR SYSTEM FOR PUBLIC PARTICIPATION IN RURAL DRINKING SAFETY PROJECT

Combining with the content and concept of public participation in rural drinking water safety project, the evaluation indicator system for public participation in operation management of rural drinking safety project is formulated, as shown in Table 1.

CONSTRUCTION OF PUBLIC PARTICIPATION IN RURAL DRINKING SAFETY PROJECT BASED ON MATTER-ELEMENT-GAHP MODEL

Based on matter-element analysis and group decision analytic hierarchy process, the evaluation model for public participation in rural drinking water safety project is constructed.

The public participation in rural drinking safety project based on matter-element-GAHP model is constructed by the following steps:

Table 1: Evaluation indicator system for public participation in rural drinking safety project

Objective	Evaluation Content
Rural drinking water safety project Evaluation on public participation in operation management	Participation degree of fund raising X_1
	Participation degree of labor investment X_2
	Participation degree of manager recruitment X_3
	Participation degree of decision-making system X_4
	Participation degree of information disclosure system X_5
	Participation degree of water usage and irrigation system X_6
	Participation degree of project maintenance system X_7
	Participation degree of dispute coordination system X_8
	Participation degree of management X_9
	Participation degree of water pricing X_{10}
	Participation degree of water fee collection mode determination X_{11}
	Participation degree of award and punishment formulation X_{12}
	Participation degree of rural water environment protection X_{13}
	Participation degree of water quality inspection X_{14}

Step 1: Determine classical domain and node domain. In this study, public participation in rural drinking water safety project includes 5 levels: Very high, relatively high, common, relatively low, very low. Therefore, various evaluation indicators of public participation in rural drinking water safety project are divided into 5 grades, Grade 1, Grade 2, Grade 3, Grade 4 and Grade 5. Grade 1 refers to very low, Grade 2 refers to relatively low, Grade 3 refers to common, Grade 4 refers to relatively high and Grade 5 refers to very high (Chen and Hu, 2003)

In the evaluation system for public participation in rural drinking water safety project, classical domain of all grades is:

$$R_01 = [Grade1 \ 0-20], \ R_02 = [Grade2 \ 20-40]$$

$$R_03 = [Grade3 \ 40-60], \ R_04 = [Grade4 \ 60-80]$$

$$R_05 = [Grade5 \ 80-100]$$

Node domain

$$R_p = [(\text{Public participation degree of rural drinking water safety project}) = [0-100]]$$

Step 2: Determine the weight of the evaluation indicator X_i . Group decision analysis is used to determine the weight of the indicators. In line with steps and requirements of AHP, the weight of the indicator is determined by various experts. Then, the arithmetic mean value of the result determined by various experts is regarded as the weight of the indicator for the public participation in rural drinking water safety project. The weight of X_i is a_i ($i = 1, 2, \dots, 14$)

Vector of indicator weight:

$$A = (a_1, a_2, \dots, a_{14})$$

In addition:

$$a_i \geq 00 \text{ and } \sum_{i=1}^{14} a_i = 1$$

- Step 3:** Matter-element to be evaluated is determined. Experts are invited to grade the above indicator system and evaluation standard for public participation in certain rural drinking water safety project. In addition, mean value of scores given by various experts is regarded as the magnitude of the indicator u_i . According to the listed indicator system, during evaluation on public participation in rural drinking water safety project, matter-element to be evaluated m is 1 which is recorded as P_0 . The calculation result is represented by R_0 which is regarded as the matter-element to be evaluated. (Han *et al.*, 2003)
- Step 4:** Determine relevance of grades j of various indicators in matter-element to be evaluated

$$K_j(x_i) = \begin{cases} \frac{\rho(x_i, x_{0i})}{\rho(x_i, x_{pi}) - \rho(x_i, x_{0i})}, & \rho(x_i, x_{pi}) - \rho(x_i, x_{0i}) \neq 0 \\ -\rho(x_i, x_{0i}) - 1, & \rho(x_i, x_{pi}) - \rho(x_i, x_{0i}) = 0 \end{cases}$$

In wich:

$$\rho(x_i, x_{0i}) = \left| x_i - \frac{1}{2}(a_{0i} + b_{0i}) \right| - \frac{1}{2}(b_{0i} - a_{0i})$$

$$\rho(x_i, x_{pi}) = \left| x_i - \frac{1}{2}(a_{pi} + b_{pi}) \right| - \frac{1}{2}(b_{pi} - a_{pi})$$

In the above equation, $\rho(x_i, x_{0i})$ is the distance between x and range x_{0i} and $\rho(x_i, x_{pi})$ is the distance between x_i and range x_{pi} .

Step 5: Calculate relevance of grades j of various indicators in matter to be evaluated P_m . If the weighted coefficient of X_i is a_i and $\sum_{i=1}^n a_i = 1$ then:

$$K_j(p) = \sum_{i=1}^n a_i K_j(x_i)$$

In this equation, $K_j(p)$ is the combined value of relevance of various grades for various indicators of matter to be evaluated with the consideration of indicator weight (Zhang *et al.*, 2006).

Step 6: Grade evaluation If:

$$K_{j_0}(p) = \max_{j \in \{1, 2, \dots, m\}} K_j(p)$$

then Pm belongs to j_0 .

CONCLUSION

In order to solve problems of operation management in rural drinking water safety project, the governmental departments should provide strong macro management and control. On the other hand, public people should participate in the operation management positively. Their right to know, right to supervise and right of decision-making and right to manage can be increased by vast participation of users which guarantees the greatest expression of effect in rural drinking water safety project. However, during the operation management process of rural drinking water safety project, there are many uncertainties. Therefore it is necessary to know the public participation in operation management of rural drinking water safety project. Based on this, the concept of public participation in operation management of rural drinking water safety project is proposed. In addition, the evaluation indicator system and evaluation model for public participation in operation management of rural drinking water safety project is established to provide certain reference and guidance for effective improvement of public participation in operation management of rural drinking water safety project.

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